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ABSTRACT

An overview of the Air Force's Research and Development Program for the Improvement of Maintenance Efficiency is provided. First described are the steps found in any detailed task analysis, a process which results in the complete specification of each task involved in an overall maintenance effort. The factors influencing maintenance effectiveness are listed and the structure of maintenance jobs outlined. Job Performance Aids (JPA), which are step-by-step guidance procedures designed to reduce maintenance personnel training needs and to improve maintenance performance, are discussed, along with the more general concept of Job Oriented Training and the specific problem of the Job Task Performance Tests required for reliable, valid measurement. The results of two experiments are also summarized; these indicate that inexperienced personnel using JPA perform maintenance tasks better than experienced personnel using traditional technical manuals. This supports the conclusion that the use of JPA improves both maintenance personnel training and the performance of maintenance tasks. (LB)

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AIR FORCE HUMAN RESOURCES LABORATORY

AFHRL-TR-72-72

DESCRIPTION AND RESULTS OF THE AIR FORCE RESEARCH AND DEVELOPMENT PROGRAM FOR THE IMPROVEMENT OF MAINTENANCE EFFICIENCY

By

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

(U) This paper is one of three prepared for a 1972 APA Symposium entitled "The Impact of Behavioral Science on the Maintenance of Machine Subsystems." This paper and its accompanying slides give an overview of the Air Force Research and Development Porgram for the improvement of maintenance efficiency. Some references to related work of other DOD agencies and civilian concerns are also made. It emphasizes the use of the task analysis process in all of these efforts. Although the central theme emphasizes the Job Performance Aids efforts,

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20. Abstract (Continued)

attention is also given to Job Oriented Training and Job Task Performance Tests. The results of two experiments are briefly summarized: (1) an experiment of the Air Force Human Resources Laboratory in which high and medium aptitude subjects with only 12 hours of training successfully accomplished checkout procedures, troubleshooting and remove and replace actions on an electronic equipment using Job Performance Aids and (2) a SAMSO (SPACE and Missile Systems Organization) experiment entitled PIMO (Presentation of Information for Maintenance and Operation) in which experienced technicians, apprentice technicians, and personnel from unrelated career fields accomplish error free maintenance on all types of flight line maintenance tasks except troubleshooting on the C-141 aircraft. In addition, a 1972 demonstration combining Job Performance Aids with Job Oriented Training is described. In this demonstration eight high and eight average electronic aptitude subjects were able to perform most types of flight line and field shop maintenance for a doppler radar and its computer.

Preface

This report represents a portion of the exploratory development program of the Advanced Systems Division of the Air Force Human Resources Laboratory. Preparation of the report was documented under Task 1710 04, Job Performance Aids for Air Force Maintenance Technicians, of Project 1710, Training for Advanced Air Force Systems. Dr. John P. Foley was the Task Scientist. Dr. Ross L. Morgan was the Project Scientist.

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in the past 20 years different agencies of the Army, Navy and Air Force have addressed this problem (12). But before addressing measurement I would like to tell you something about Job Performance Aids and its integration with Job Oriented Training.

JOB PERFORMANCE AIDS

4 The JPA technology as developed by the Air Force Human Resources Laboratory are not as some people think, just a book of step-by-step job procedures with supporting pictures. Although, that is what the casual observer sees. What is not seen and what gives JPAs their effectiveness is the careful systematic control of their content. JPAs are the optimum end product of a comprehensive developmental process. This process starts with a complete task analysis. What is unique about the task analysis is its systematic, consistent and integrated consideration of many factors affecting the performance of each maintenance task identified by the task analysis. I want to emphasize the word each. Some of these factors include the type of equipment, its maintenance concept, the levels of maintenance to which tasks are assigned, the type of test equipment, the aptitude of the user, and the "head-book" trade off. By "head-book trade off" is meant what the user is expected to bring to the task that is stored in the man as against what is stored in the aid. A little later this morning Dr. Jack Folley will tell you something about the development of these structured task analysis procedures and their resulting sub-products which, after development, serve as criteria for the content of the aids (2, 15).

Factors Affecting Maintenance Effectiveness

5 This development of a workable procedure for the systematic consideration of such factors did not just happen. In 1961 and

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1962 Dr. John A. Modrick of the then Training Research Division of the Behavioral Sciences Laboratory of the Aerospace Medical Research Laboratories and Dr. John D. Folley, Jr. of the American Institutes for Research started by giving systematic consideration to many factors concerned with the effectiveness of maintenance. For this consideration an equation such as the following was used:

$$M_{eff} = f\ (E, TE, HT, D, P)$$

The effectiveness of maintenance (M_{eff}) is a function of several gross factors such as the characteristics of the equipment to be maintained (E); the test equipment (TE) and hand tools (HT) to be used during maintenance; the technical information and/or instructions provided (D); and the relevant skills of the people assigned to perform the maintenance (P). (Each of these functions can be expanded into a list of sub-functions. In the interest of time I have delegated a fuller expansion of this formula to appendix A.)

Traditionally, the variable in this equation, which has been expected to compensate for the weaknesses or shortcomings of the other variables, has been the "people" variable. Because of the high turnover of maintenance personnel in the military setting, on the average, "people" have had the shortest life cycle of any of the other gross variables. As a result of high turnover during the life cycle of most equipments or systems, the training of people to perform maintenance has been extremely expensive over the life cycle of most equipment or hardware systems. As a result important questions to be answered in 1962 were, and in 1972 still are: "What can be done to reduce costly training?". "What can be done to improve the performance of the maintenance man?".
Dr. Modrick hypothesized that improved job information and instructions were likely candidates.

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The Structure of the Maintenance Job

After a review of the literature (17) and some preliminary development and tryouts of aids (13, 18), a Maintenance Task Simulator of a Bomb Navigational System was built and an indepth study (8, 9, 10) was made of checkout procedures. It was found that step-by-step guidance greatly reduced the need for training and improved the performance of checkout tasks (7). This work was expanded to between stage troubleshooting and later to within stage troubleshooting. In all of this early work, remove and replace actions and use of test equipment were assigned to training.

6 A three dimensional functional structure or working model of the Air Force maintenance job such as shown on this slide is a convenient way of presenting what gradually emerged. The various types of maintenance activities just mentioned are represented by one axis of the model. Since mechanical equipment and electronic equipment usually require a different variety of maintenance actions, they are represented by another axis.

The third axis represents the three levels or categories of maintenance now found in the military services. Organizational maintenance is the first level. It is usually aimed at checking out a whole machine subsystem and correcting any identified faults as quickly as possible. Flight line maintenance falls in this category. A system is checked out. If it does not work, the line replaceable unit (LRU) or "black box" causing the malfunction is identified and replaced. The major component is then taken to the field shop (intermediate maintenance) where it is again checked out and the faults, authorized for correction, are corrected. The corrective actions, authorized at the intermediate level, vary greatly from system to system depending on the maintenance concept of each system.

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On some systems, the maintenance man will troubleshoot the black box to the piece part level. In more modern equipment, he will identify a replaceable module made up of many piece parts. Some modules are thrown away, other sent to the depot for repair. Any line replaceable units which the field shop are unable, or unauthorized to repair are sent to the depot for overhaul.

Organizational and intermediate level organizations are manned primarily by enlisted technicians whose average length of service is rather short (slightly more than 4 years in the Air Force). Depots are manned largely by civilian personnel with a much higher level of experience and longer retention time. Using this model it has been possible to develop job performance aids that considered training, aptitude, and experience of personnel variables as well as equipment and test equipment variables.

History and Results of Job Performance Aid Programs

7 As stated earlier the AFHRL work in 1962-63 addressed checkout
8 procedures of electronic equipment. In the 1963-68 time frame this work expanded to between and within stage troubleshooting; some align and adjust procedures; and remove and replace activities. In the
9 1966-68 time frame a controlled experiment (11) was conducted that indicated that (with only 12 hours of specific training on how to use test equipment, how to use "hand tools"), both High and Medium aptitude high school subjects could perform checkout procedures, troubleshooting, and remove and replace activities in an equally acceptable manner as experienced, high aptitude, experienced, personnel with many months of training. The high school subjects used job performance aids; the experienced technicians used Technical
10 Order materials. This was an encouraging finding. As a result in the 1968-1970 Fully Proceduralized Aids were being developed for a doppler radar, the AN/APN-147, and its computer the AN/ASN-35.

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These aids covered both organizational and intermediate maintenance but only for maintenance tasks on electronic equipment.

11 From 1964 to 1969 a concurrent effort called PIMO was being conducted under the management of the Ballistic Systems Division (now SAMSO) of the Air Force Systems Command (PIMO is an acronym for Presentation of Information for Maintenance and Operation). Although managed by BSD, the Behavioral Sciences Laboratory was actively represented on the steering committee - first by Dr. Kirk Johnson, and later by Mr. Jerry Chubb and myself. (Jerry Chubb is one of our discussants this morning. The principal investigator for the PIMO project was Dr. Kay Inaba of Serendipity, Inc. He is now president of XYZYX Information Corporation.) This effort addressed itself to
12 the Organizational Maintenance Tasks of the C-141 Aircraft. As you can see from the slide, fully proceduralized job performance aids called job guide manuals were prepared for the straight line tasks-checkout; align and adjust; and remove and replace tasks. These aids covered both mechanical and electronic tasks. But for trouble-shooting an older type of Technical Data, called SIMMs (Symbolic Integrated Maintenance Manuals), was used. The effectiveness of the fully proceduralized aids were compared with technical orders in a controlled experiment at Charleston AFB, S. Car. The results of this work are reported in an eight volume Technical Report (19, 20, 21, 23, 25, 26, 27 & 29). Volumes I and II (19, 23) of this technical report indicate that experienced aircraft mechanics, apprentice aircraft mechanics and personnel from unrelated career fields were able to perform error free maintenance when using the job guide manuals. The experienced personnel made errors when performing with technical orders, and the apprentices and other personnel were not able to perform adequately with Technical Orders.

Vietnamization and the Development of Specifications

The promising results of this experiment and the AFHRL experiment discussed earlier led to applying Job Performance Aids to selected

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13 systems for Vietnamization. In Dec 1969 the first Development Directive was issued for Aids for the flight line maintenance on the UH-1H. This was followed by the C-123 and the CH-47. The Air Force experience with buying Job Performance Aids for the UH-1H

14 indicated the need of a more precise specification which would insure the adequate and consistent consideration of all job tasks and the development of adequate and consistent instructions for accomplishing each task. This was done by requiring the development of a structured task analysis and a number of sub-products. These sub-products must be used by the Job Performance Aids manager purchasing the aids to guarantee the quality and quantity of the content of the aids (2). In addition "How to" handbooks were prepared for Job Performance Aids Developers and Managers (3, 4). The specification and handbooks, in my opinion, were critical requirements - until they were developed we did not have a technology. These guidance documents have since been modified for American use as a three volume AFHRL Technical Report (15, 16, 22).

15 The documents have been used to purchase aids for 7 additional systems under contracts to Westinghouse and STC for the Aeronautical Systems Division of AFSC. Another important application has been the

16 development of Job Performance Aids for all three levels of maintenance for an electronic system called Seek Point. This particular extension of the technology is being developed under contract by Applied Science Associates for the Electronic Systems Division of AFSC.

As an exploratory development project, AFHRL has developed JPAs

17 for Organizational and Intermediate maintenance of a J-85 jet engine- expanding our experience to include mechanical tasks for the intermediate level of maintenance. Summarizing our coverage we have now

18 developed fully proceduralized aids for all types of maintenance except mechanical tasks at depot level.

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19 As indicated earlier we now have Americanized draft specifications and guidance for the development of aids for both mechanical and electronic maintenance tasks at the Organizational level. These documents have been published as AFHRL-Technical Report-71-53 (15, 16, 22). I have a few of these with me for those interested.

20 In addition AFHRL has published a companion document that extends the application of the TR-71-23 to include not only organizational but also

21 intermediate maintenance for electronic subsystems (6). AFHRL has an effort in progress which will update these documents and expand them to include intermediate maintenance. These documents should be published early in 1973.

JOB PERFORMANCE AIDS AND JOB ORIENTED TRAINING

All of the above job performance aids efforts have had as a common objective the improvement of the performance of maintenance. The AFHRL has had added the objective of improved training. As a part of our advanced development program, we have developed matching job oriented training for jobs modified by job performance aids.

22 This past spring we conducted a tryout and demonstration of such training and Job Performance Aids for the AN/APN-147 and AN/ASN-35 at Altus AFB, Okla. We took eight high electronic aptitude subjects and eight medium subjects directly from basic training at Lackland AFB. These subjects had received no previous technical training. These subjects were given a four weeks training program on how to use test equipment, handtools, and JPAs. These subjects were able to perform most of the typical organizational and intermediate maintenance tasks given them.

23 During the coming year, we plan to conduct a controlled experiment to determine the relative effectiveness of Job Performance Aids, SIMMs Aids, and Technical Orders when used by personnel of varying levels of training, aptitude, and experiences. We will have airmen who have just graduated from the appropriate Air Force electronic technical course, as well as, experienced personnel, perform typical

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maintenance tasks using Technical Orders, SIMMs type aids and Job Performance Aids. These will all be high aptitude people. We plan to compare their performance with novice personnel of high and average aptitude with a shorter amount of training but of the job oriented type. These novices will use only Fully Proceduralized Job Performance Aids.

24

THE MEASUREMENT OF PERFORMANCE OF JOB TASKS

Measurement of the technicians' ability to perform maintenance tasks as mentioned earlier has been another area of work which is basic to any research in either training or technical data. The need for better measurement procedures was early identified as one of the problems requiring research and development in connection with the design of better performance aids (14). But all three services have addressed this problem from time to time. Some examples of such work are mentioned. In the 1950's the Air Force Personnel and Training Research Center as well as the Office of Naval Research supported research and development on Job Performance Measures. HumRRO has made use of Job Performance Measures on an ad hoc basis for many of their projects. In the late 1940's and early 1950's Air Training Command operated check rooms in their schools where students were measured concerning their ability to perform maintenance tasks independent of their instructors. In the early '60's U.S. Navy Personnel Research Activity at San Diego made extremely good use of such tests in their study of the proficiency of Navy electronic technicians in their Use of Test Equipment. But little had been done since the 1950's for improving job performance test technology for maintenance tasks per se.

As early as 1963, some preliminary work was accomplished by our Training Research Division in-house. But in 1966 work began in earnest. An extensive review of the literature was completed in 1967

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(12). This work was organized around a structure similar to that shown before. One of the outcomes of this work was a conclusion that

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most of the earlier work on job performance testing had attempted to express the results of job performance testing under the umbrella of one score. It was hypothesized that tests should be developed for each type of job activity and that an appropriate scoring scheme should be developed for each. The result would be a profile of scores for each subject.

Based on these hypotheses, a contract was let to the Matrix
26 Research Division of URS Systems. Job Task Performance Tests have been developed, under the direction of Dr. Edgar Schriver of that organization, for each type of maintenance activity for the AN/APN-147, doppler radar and its computer the AN/ASN-35. These tests will be used as criterion tests in our forthcoming Job Performance Aids Experiment. We, also, developed some job task performance tests for
27 typical organizational tasks for the UH-1H Aircraft for Vietnamization. Dr. Schriver will discuss these test development efforts as well as some of our more recent work on symbolic substitute tests which he has been doing under contract for our Laboratory.

SUMMARY

28 This morning I have given you an overview of the Air Force's Research and Development Program for the improvement of Maintenance Efficiency, with special attention to Job Performance Aids, Job Orientated Training and Job Task Performance Tests. All of these programs have been the result of systematic study of the maintenance job commonly called task analysis. Jack Folley will follow with a more indepth treatment of the Job Performance Aids Technology. He will be followed by Ed Shriver who will talk about measurement. We will then have a short panel discussion of the problems involved in getting the JPA technology implemented.

29

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Appendix A

Reference is made to formula presented on page 3 of the basic paper:

$$M_{eff} = f(E, TE, HT, D, P)$$

Where:

E - represents Equipment

TE - represents Test Equipment

HT - represents - Hand Tools

D - represents - Technical Information or instructions about equipment.

P - represents Personnel or People assigned to accomplish the maintenance.

This is a very convenient device to use when considering various aspects of maintenance. Its usefulness is increased when these gross functions are expanded into sub-functions which effect what maintenance people must do or describe the attributes of maintenance people, for example:

1. E - Equipment can be expanded into

   E_R - The Reliability of the equipment and its components - The more reliable the equipment the lower the amount of maintenance required. Some sub-systems have been developed to the point that they seldom fail.

   E_E - The complexity of the Equipment may be very important to the maintenance man depending on the maintenance concept or the type of maintenance instruction provided. If he is required to repair or replace everything that can fail to the piece part level, the complexity of equipment is important. If he is only expected to identify, repair or replace a few items on an equipment, or if he has very detailed instructions, its complexity may be of little importance.

   E_D - Design for Maintainability - If equipment is designed with maintenance in mind, the maintenance tasks become easier.

E_C - The maintenance concept is closely related to maintainability. What should be done where? - If the maintenance concept calls for only "black box" maintenance of the organizational or flight line level (and for only module maintenance at field shop or intermediate level, the maintenance tasks at the flight line and in the field shop are rather simple but those at the depot may be extremely difficult.

E_S - Standardization of Equipment reduces the number of types of maintenance tasks to be performed.

2. TE - Test Equipment - In a similar manner this gross function can be expanded into:

TE_G - General Test Equipment

TE_S - Special Test Equipment

TE_A - Automatic Test Equipment

3. HT - Hand tools can be expanded into:

HT_G - General hand tools

HT_S - Special hand tools

4. D - Data - Technical information or instructions about equipment can be expanded into:

D_C - Content of Data - What degree of aiding is furnished? Does the data give only information about the equipment organized as to equipment functions or does it give step by step instructions organizational as to the tasks to be performed? - What is put in the book? What is the maintenance man expected to bring to the task job?

D_F - Format of Data - size of page, size of book.

D_M - Mode of Presentation (Book, Audio-visual Presentation, Computer Presentation).

All of the functions and sub-functions affect what the maintenance man faces when called on to maintain a given equipment. How well he reacts depends on a sub-set of another gross variable the P - People or personnel functions.

P_A - Aptitude (High, Medium or Low)

P_T - Type and length of training - were the training objectives general or precise? How relevant was the content of training to the content of the job or task at hand?

P_{EX} - Experience - The types of previous job experiences the individual has had.

P_M - Motivation - How well motivated is he to do the task at hand? Is he rewarded for doing his job tasks well or is he rewarded for something else? For example - Ability to tell jokes.

The P - variable also contains another set of sub-functions that indirectly affects the maintenance man's behavior.

P_P - Promotion system - is it based on his demonstrated ability to do the major tasks of his job? Or is it based on his ability to pass a paper and pencil test about his job or about more abstract theory?

P_O - Organizational Structure and

P_N - Number of Personnel - both of these may have an effect on his ability to be promoted among other things.

P_C - Culture - How well does the man fit the traditional cultural norms of his job society?

The above expansion and treatment is not intended to be complete but to give some idea of the thought processes involved in our Air Force Human Resources work concerning job analysis. An indepth consideration of some of the factors will indicate that some may be positive factors for maintenance. Others may be neutral, and some may be negative.

APPENDIX B - SLIDES

LIST OF SLIDES

Slide 1 - AFHRL

2 - Title Slide

3 - Task Analyses of Maintenance Jobs

4 - Picture of JPA Book

5 - Factors Effecting Maintenance Effectiveness

6 - A Functional Representation of the Air Force Maintenance Structure

7 - AFHRL 1962 - 1963 Effort

8 - AFHRL 1962 - 1970 Effort

9 - AFHRL JPA Experimental Results

10 - Same as Slide 8

11 - PIMO Project

12 - PIMO Experimental Results

13 - Vietnamization 1969 - 1972

14 - Draft Specifications and Handbooks

15 - Same as Slide 13

16 - JPAs for Seek Point

17 - JPAs for Jet Engine

18 - JPA Summary

19 - Same as Slide 14 (AFHRL-TR-71-53)

20 - Draft Specifications for Electronic Maintenance

21 - Expanded Draft Specifications for Organizational and Intermediate Level

22 - Demonstration - Altus AFB 1972

23 - Advanced Development Experiment I

24 - Job Task Performance Tests

25 - Same as Slide 6

26 - Job Task Performance Tests (AN/APN-147 & AN/ASN-35)

27 - Job Task Performance Test (UH-1H)

28 - Summary Slide

29 - AFHRL

DESCRIPTION AND RESULTS
OF THE
AIR FORCE RESEARCH AND DEVELOPMENT PROGRAM
FOR THE
IMPROVEMENT OF MAINTENANCE EFFICIENCY

SLIDE 2

TASK ANALYSES OF MAINTENANCE JOBS

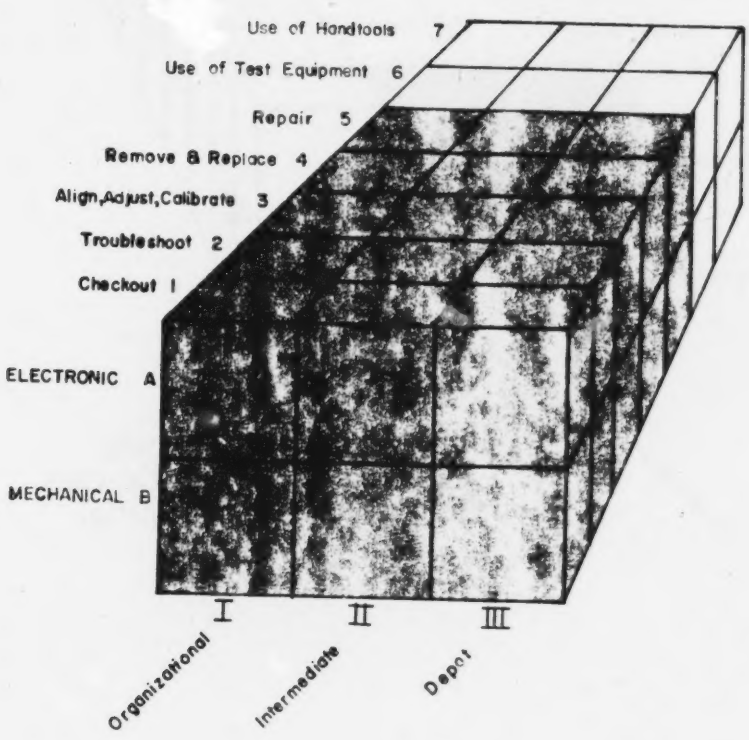
- JOB ORIENTED TRAINING
- JOB ORIENTED MAINTENANCE GUIDANCE (JOB PERFORMANCE AIDS)
- JOB TASK PERFORMANCE TESTS

SLIDE 3

FACTORS AFFECTING MAINTENANCE EFFECTIVENESS

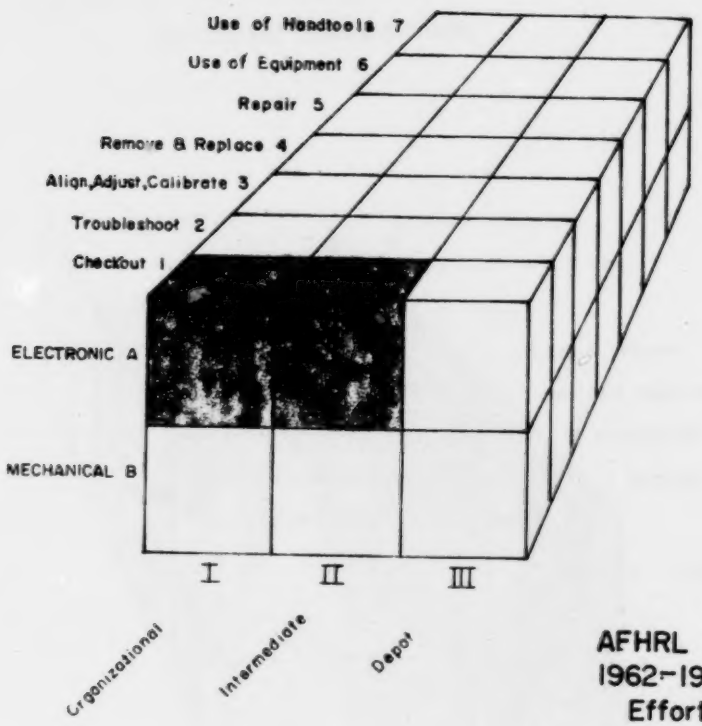
- M_{eff} = f (E, TE, HT, D, P)
  - M_{eff} - Effectiveness of Maintenance
  - E - Equipment
  - TE - Test Equipment
  - HT - Hand Tools
  - D - Data - Information and Instructions
  - P - People or Personnel

A Functional Representation of the AF Maintenance Structure



SLIDE 6

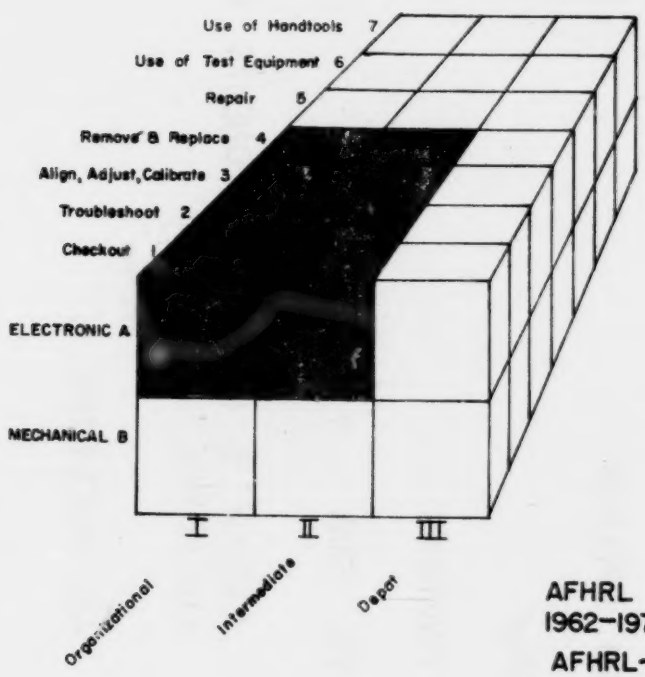
A Functional Representation of the AF Maintenance Structure



AFHRL
1962-1963
Effort

SLIDE 7

A Functional Representation of the AF Maintenance Structure



AFHRL
1962–1970
AFHRL-TR-68-1

AFHRL EXPERIMENT 1967 - 68

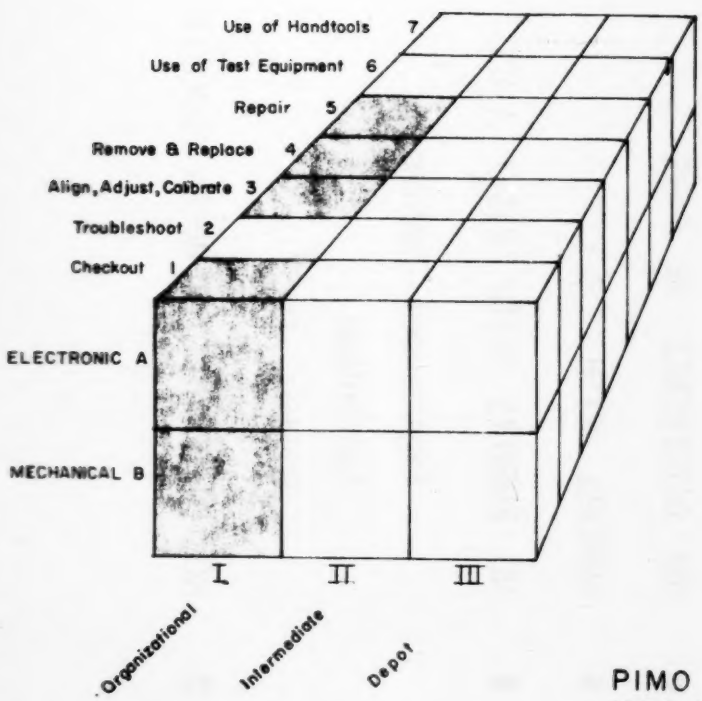
NEW TYPE AIDS	vs	TECH ORDERS
HIGH SCHOOL		5 & 7 AF TECHNICIANS
HIGH & MED APTITUDE		HIGH APTITUDE ONLY
NO EXPERIENCE		3 - 7 YRS. EXPERIENCE
12 HOURS TRAINING		40 + WEEKS TRAINING
NO SPEC. EQ. FAM.		3 HRS. SPEC. EQ. FAM.

TASK: ISOLATE & REPAIR COMPONENTS IN COMPLEX ELECTRONIC SUBSYSTEM

RESULTS: NO DIFFERENCE

SLIDE 9

A Functional Representation of the AF Maintenance Structure



PIMO
1964-1968

RESULTS OF PIMO EXPERIMENT 1968 - 69

(JOB GUIDE MANUALS)

- NO DIFFERENCE IN TIME
- ERRORS WITH T.O.s
- NO ERRORS WITH PIMO AIDS

  Experienced Technicians

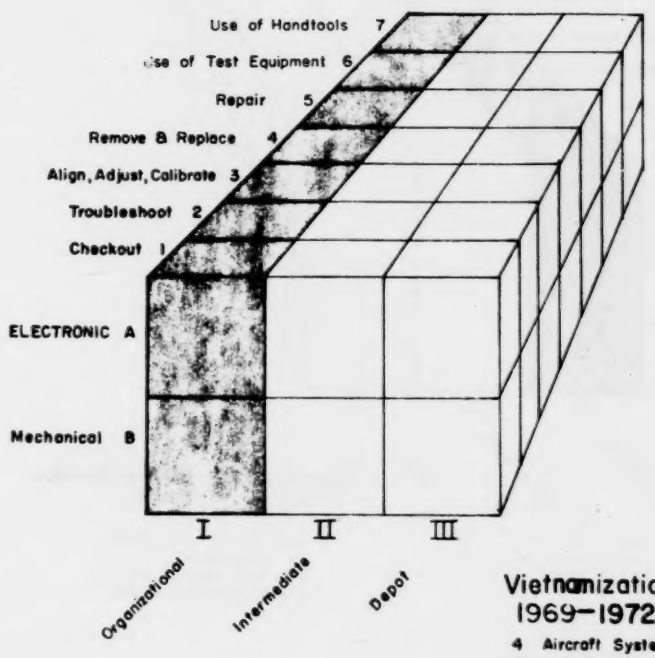
  Apprentices

  Welders, Etc.

- NO DIFFERENCE BETWEEN BOOKLET AND A - V SYSTEMS

SLIDE 12

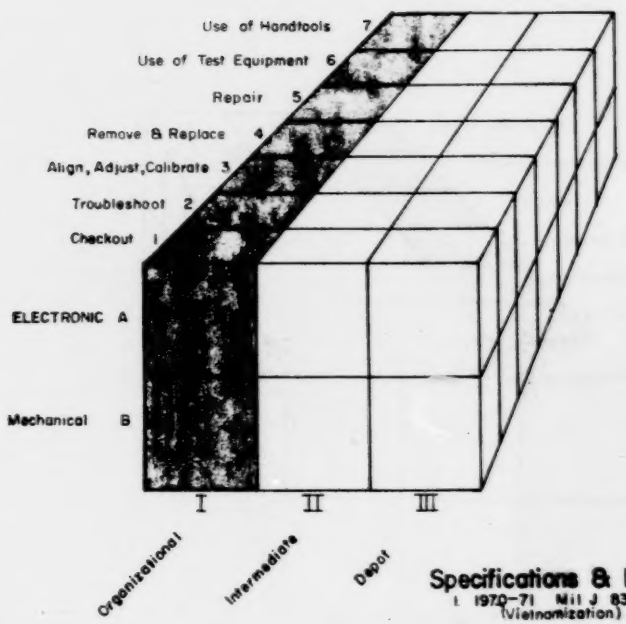
A Functional Representation of the AF Maintenance Structure



Vietnamization (ASD) 1969–1972

4 Aircraft Systems
3 Aircraft Engine
2 Fire Trucks
1 Refueling Vehicles

A Functional Representation of the AF Maintenance Structure



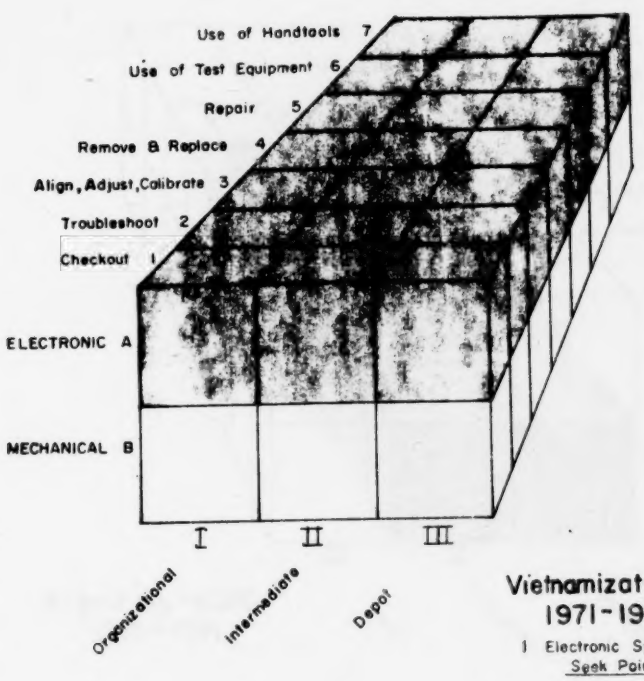
Specifications & Handbooks

1. 1970-71 Mil J 83302 (Vietnamization)
2. 1971—AFHRL-TR-71-53 (American)

Electronic and Mechanical Organizational Level Only

SLIDE 14

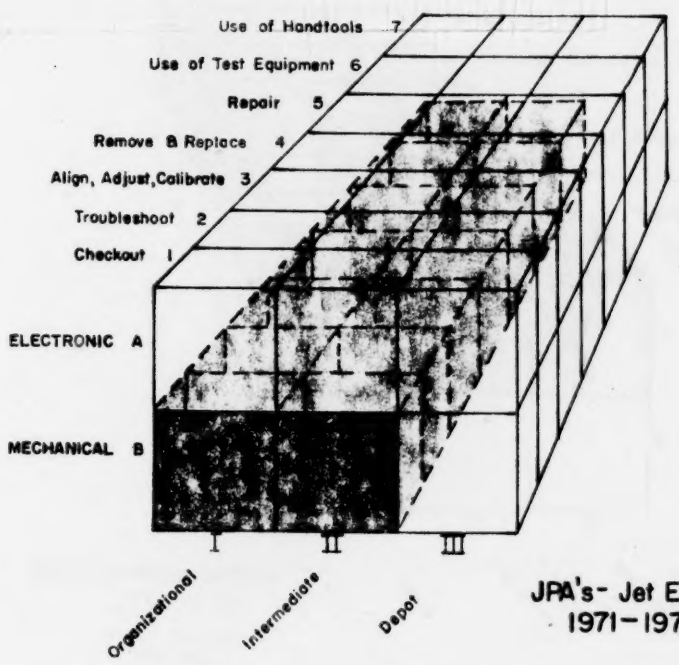
A Functional Representation of the AF Maintenance Structure



Vietnamization (ESD)
1971-1972

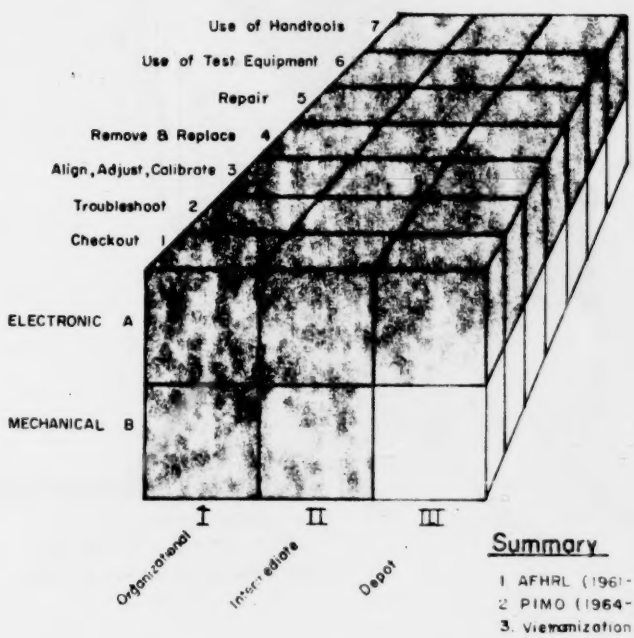
1 Electronic System
Seek Point

A Functional Representation of the AF Maintenance Structure



JPA's - Jet Engine
1971 - 1972

A Functional Representation of the AF Maintenance Structure

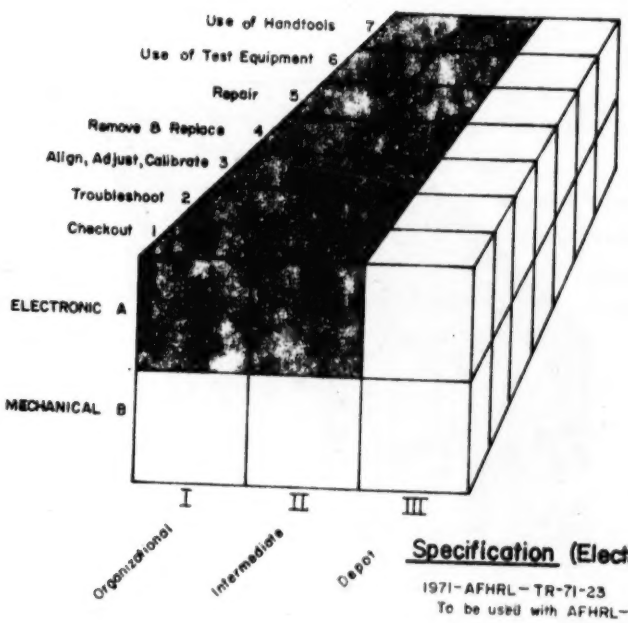


Summary

1. AFHRL (1961-72)
2. PIMO (1964-68)
3. Vietnamization (1969-72)

SLIDE 18

A Functional Representation of the AF Maintenance Structure

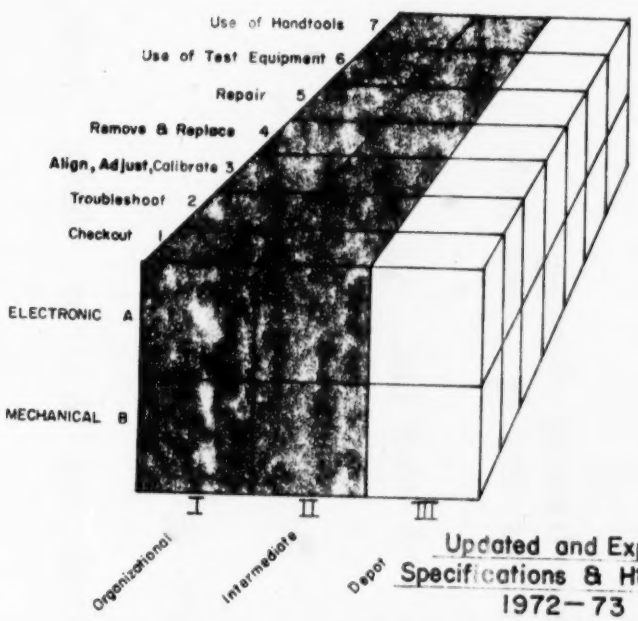


Specification (Electronic Equip)

1971-AFHRL-TR-71-23
To be used with AFHRL-TR-71-53

Organizational and Intermediate Levels
Electronic Only

A Functional Representation of the AF Maintenance Structure



Updated and Expanded Specifications & Handbooks 1972–73

Organizational and Intermediate Levels
Mechanical and Electronic

JPA - JOB ORIENTED TRAINING DEMONSTRATION

MAR - APR 1972

- 4 Week Training Program
  (JPAs, Test Eq., Hand Tools)
- 8 Hi - 8 Med Elec. Apt. Subjects
- JPAs - APN-147 & ASN-35
- 2 Week Demonstration
- Performed Org. & Inter. Maint. Tasks

SLIDE 22

ADVANCED DEVELOPMENT

EXPERIMENT I

MAR - NOV 1973

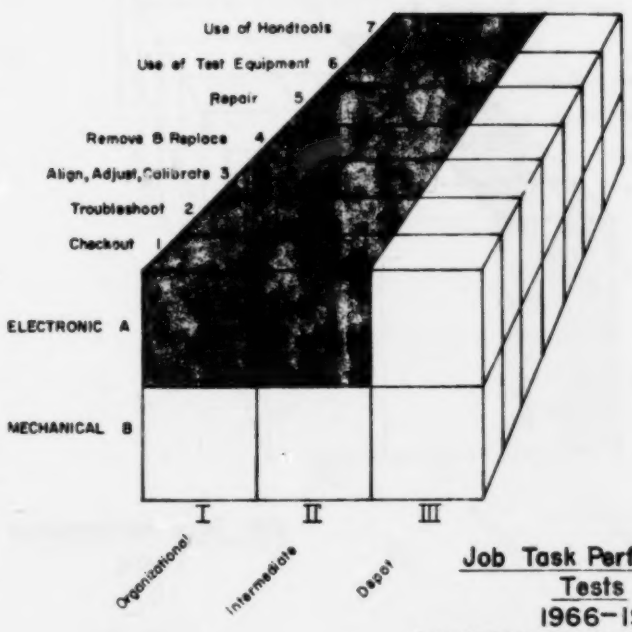
- EFFECTIVENESS OF JPAs vs TOs vs SIMMs
- AN / APN - 147 and AN / ASN - 35
- NOVICES, APPRENTICES, TECHNICIANS
- VARIOUS TYPES OF TRAINING
- OTHER CRITERIA - COST OF PREPARATION, TIMELINESS OF UPDATE, RELIABILITY OF MAINTENANCE, SPAREPARTS, MANPOWER REQUIREMENTS, TRAINING COSTS

SLIDE 23

JOB TASK PERFORMANCE TESTS

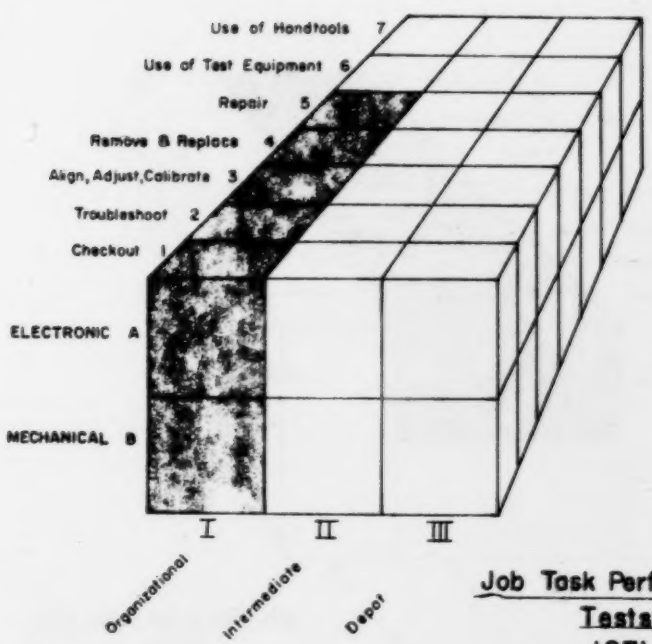
SLIDE 24

A Functional Representation of the AF Maintenance Structure



Job Task Performance Tests
1966-1971
(AN/APN-147 & AN/ASN-35)

A Functional Representation of the AF Maintenance Structure



Job Task Performance Tests
1971
(UH-1H)

SUMMARY

- Job Oriented Training
- Job Performance Aids Research - Dr. Jack Folley
- Job Performance Aids / Matched Training
- Job Task Performance Tests - Dr. Ed Shriver

SLIDE 28

Key To Abbreviations

1.	ASD	Aeronautical Systems Division of AFSC
2.	AFHRL	Air Force Human Resources Laboratory
3.	AFSC	Air Force Systems Command
4.	AMRL	Aerospace Medical Research Laboratories
5.	ASA	Applied Science Associates
6.	AIR	American Institute Research
7.	BSD	Ballistic Systems Division
8.	FPJPA	Fully Proceduralized Job Performance Aids
9.	FPTSA	Fully Proceduralized Troubleshooting Aids
10.	HumRRO	Human Resources Research Organization Formerly Human Resources Research Office of George Washington Univeristy, Washington, D.C.
11.	JPA	Job Performance Aids
12.	KENTRON	Fully Owned Subsidy of LTV
13.	LRU	Line Replaceable Unit
14.	LTV	Ling-Temco-Vought, Inc.
15.	MTS	Maintenance Task Simulators
16.	PIMO	Presentation of Information for Maintenance and Operation
17.	SAMSO	Space and Missile Systems Organization
18.	STC	Service Technology Corporation now KENTRON
19.	XYZYX	XYZYX Information Corp.